

AMENDMENTS TO THE DRAWINGS

The replace the 7 sheets of drawings originally filed with this application with the attached 7 sheets of replacement drawings of Figures 1A - 8.

Attachment: Replacement Sheet(s)

REMARKS/ARGUMENTS

Reconsideration and allowance in view of the foregoing amendment and the following remarks are respectfully requested.

Claims 1-3 and 5-10 remain pending.

The drawings were objected to as allegedly failing to show the two circles referenced in original claim 10. Reconsideration is respectfully requested in view of the revision to claim 10 and the comments presented hereinbelow.

It is respectfully noted that the two circles and intersecting line referenced in claim 10 and in the specification were simply referring to the linear taper of the conical portion, the circles being the outer circumference of the cross-section at each end of the linear taper. Thus, the "circles" would only be seen in plan and in the pending figures would be represented by a horizontal line, such as the horizontal line at K in Figure 2B. Claim 10 has been revised above for clarity so as to refer to the linear taper and to omit the reference to circles to avoid confusion in this regard. No new matter has been added.

Reconsideration and withdrawal of the objection to the drawings is respectfully requested. In the meanwhile, formal drawings corresponding to the drawings originally filed in this application are attached hereto. It is respectfully requested that the attached formal drawings be substituted for the informal drawings originally filed with this application.

The Examiner objected that the title of the invention was not descriptive and required a new title. The title has been revised above so as to be more descriptive of the invention which the claims are directed. If the Examiner would prefer another title, it is respectfully requested that the title be revised by Examiner's Amendment or that the Examiner propose a new title in the next Official Communication.

Claim 10 was objected to as including a noted informality. Claim 10 has been amended above so as to obviate the grounds for this objection.

Original claims 1-10 were rejected under 35 USC 102(a) as being unpatentable over GB '641 in view of Kato. Applicant respectfully traverses this rejection.

Claim 1 has been amended above to incorporate the limitations of original claim 4, to underscore the unique combination of the invention and how it is distinguished from the applied art. In this regard, in a compact spark plug as shown in Figure 1B of the present application, when the columnar portion 32 has a small diameter $\phi 1$, e.g., in the range of 0.4 to 0.8 mm, the taper angle $\theta 1$ of the conical portion 31 has an influence on the discharge voltage (the voltage required to induce spark discharges across the discharge gap 50) despite the relatively large length L1 (i.e., 0.3 to 1.0 mm) of the columnar portion 32.

In other words, with the small diameter $\phi 1$ of the columnar portion 32, the taper angle $\theta 1$ of the conical portion 31 still affects the discharge voltage even though the conical portion 31 is relatively far away from the discharge gap 50.

The inventors of the present invention have found, through experimental investigation, that the discharge voltage of such a compact spark plug can be lowered through specifying the taper angle $\theta 1$ of the conical portion 31 to be less than 80° .

In comparison, in the spark plug disclosed in Benedikt GB '651, the frusto-conical ignition portion 20 is very close to the discharge gap. More specifically, there is only the thin platinum coating 22 (1.0 – 1.5 mm wide and 10-100 μm thick) between the frusto-conical ignition portion 20 and the discharge gap. Therefore, it is impossible for one of ordinary skill in the art to derive from Benedikt GB '641 the subject matter of the present invention and the combination of structural features and dimensions claimed.

Further, in the spark plug disclosed in Kato '684, although heat resistant metal tip 5 is provided between the frusto-cone shaped portion 32 and the discharge gap, the taper angle of the frusto-cone shaped portion 32 is 90° (Fig. 2, column 4, lines 50-65) which exceeds the claimed range of less than 80°. Therefore, Kato did not apparently recognize the subject matter of the present invention either and teaches away from the invention. Further, although the Examiner has noted teachings in Kato of a tip diameter between 0.5 mm and 0.7 mm and a columnar length of .8 mm, it is respectfully submitted that it would be unobvious to modify GB '641 to adopt the noted dimensions of Kato. In this regard, GB '641 provides a very clear teaching of a very limited platinum coating and expressly teaches a range of diameters and a range of thicknesses of the platinum coating. It would be unobvious to modify the dimensions specifically disclosed by GB '641 without a motivation in the prior art of record for doing so.

Section 103 does not allow the Examiner to engage in picking and choosing from the prior art only to the extent that it will support a holding of obviousness, while excluding parts of the prior art essential to the full appreciation of what the prior art suggests to one of ordinary skill in the art. In re Wesslau, 147 USPQ 391 (CCPA 1975).

As the CAFC has said, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. ACS Hospital Systems v Montefiore Hospital, 221 USPQ 929, 933 (Fed. Cir. 1984). There must be a suggestion in the art relied upon to use what one reference discloses in or in combination with the disclosure of the other reference or references relied upon by the Examiner. In re Grabiak, 226 USPQ 870, 872 (Fed. Cir. 1986).

In view of the foregoing, it is respectfully submitted that one skilled in the art, from a review of the prior art documents cited by the Examiner, would not derive the invention recited in applicant's claims. It is therefore respectfully submitted that claim 1

is not obvious from the prior art cited by the Examiner. Indeed, as noted above, Kato teaches a taper angle of approximately 90° and thus teaches away from the invention claimed by applicant and in fact teaches away from the taper angle disclosed in the GB reference. Therefore, clearly one skilled in this art would use the spark plug of the GB reference or the spark plug of Kato in the alternative and would not attempt to piecemeal combination thereof.

Claims 1 and 5-10 were also rejected under 35 USC 103(a) as being unpatentable over Matsubara. Applicant respectfully traverses this rejection.

In the spark plug disclosed in Matsubara, though a noble metal tip 34 is provided between the tapered section 33 and the discharge gap, the length of the noble metal tip 34 is not described. It seems (from Figures 1 and 2) that the length of the noble metal tip 34 is very small, in other words that the tapered section 33 is very close to the discharge gap.

The Examiner suggests that "the particulars" of the claimed invention not taught by Matsubara would have been "obvious" because discovering an optimum value involves only routine skill in the art. It is respectfully submitted, however, that the prior art cited by the Examiner does not teach experimentation in regard to the Matsubara structure so as to determine an "optimum" length or width of the columnar portion, much less in relation with the taper angle. Therefore, without guidance from the prior art as to what "optimization" or "experimentation" would be appropriate, it is respectfully submitted that the Examiner cannot properly summarily conclude that "optimization" of Matsubara would lead to the invention claimed. Note that the Matsubara disclosure refers to an apex angle of 110° or less and therefore clearly does not envision the importance of the lesser range claimed by applicant of 80° or less. Moreover, Matsubara fails to teach the dimensions of the columnar portion as claimed herein. In view of the deficiencies of the Matsubara disclosure with respect to the


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March 9, 2006

invention claimed, the routiner in the art would not obviously arrive at the invention claimed through routine experimentation on Matsubara.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYTE P.C.

By: 
Michelle N. Lester
Reg. No. 32,331

MNL:slj
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100